A1 cont'd

21 (new) The electrochemical cell as defined in claim 16, wherein the expanded graphite particles have a kerosene absorption value in the range of 2.7 to 3.1 ml/g.

REMARKS

By way of this Amendment, new claims 18-21 have been added. Claims 1-21 are present in this application. Applicant respectfully requests reconsideration and allowance of the present application.

In the present Office Action, claims 1-17 were rejected under 35 U.S.C. §103(a) as being unpatentable over Mototani et al. (U.S. Patent No. 5,482,798). Applicant submits that claims 1-17, as well as new dependent claims 18-21, clearly distinguish over the art of record, and claims 1-21 should be allowed for the reasons noted as follows.

Before discussing the rejection, it is important to appreciate Applicant's invention and the advantages realized therefrom. The present invention provides for the addition of an enhanced electrically conductive graphite material to the cathode of an electrochemical cell. The graphite material includes expanded graphite particles having a kerosene absorption value in the range of 2.2 to 3.5 ml/g according to one aspect of the invention. According to another aspect of the invention, the expanded graphite particles have a purity level of greater than 99.9 percent. It should be appreciated that the conductive matrix provided by the expanded graphite particles have certain characteristics which Applicant has discovered allow for low volume consumption by the conductive matrix and improved polarization so as to achieve

enhanced cell performance. Accordingly, enhanced cell performance is achieved by employing a cathode containing expanded graphite having certain characteristics according to the teachings of the present invention.

Applicant believes that when expanded graphite having too low of a kerosene absorption value is employed in the cathode, insufficient KOH liquid is absorbed, resulting in excessive polarization, and requiring a larger amount of expanded graphite be employed. In contrast, when the expanded graphite has too high of a kerosene absorption, the cathode exhibits poor mold characteristics and allows excessive liquid KOH to collect at the cathode-to-can interface which results in excessive polarization and requires additional liquid KOH be employed. By employing an expanded graphite having a kerosene absorption value in the range 2.2 to 3.5 ml/g, the above noted problems which exist in conventional cells employing expanded graphite are avoided, thereby resulting in superior cell performance. Accordingly, Applicant submits that claim 1, and the corresponding dependent claims 2-10, are not rendered obvious in view of Mototani et al.

The reference to Mototani et al. discloses an alkaline battery having a positive electrode active material comprising manganese dioxide and electroconductive carbon material. The electroconductive carbon material in Mototani et al. comprises expanded graphite particles having an average particle size in the range of 0.5 to 15 micrometers, and used in the amount of 2 to 8 percent by weight based on the solids in the positive electrode active material. Column 3, lines 40-52 of Mototani et al. further discloses an example of a battery

having electroconductive carbon material in the range of 0.5 to 30 micrometers, and expressly provides that the expanded graphite employed is a conventional expanded graphite.

In contrast, Applicant's claimed invention as recited in claim 1 provides for an electrochemical cell comprising a positive electrode having an active material and an electrically conductive carbon material including expanded graphite particles having a kerosene absorption value in the range of 2.2 to 3.5 ml/g. Nowhere does Mototani et al. teach or suggest a kerosene absorption value in the claimed range. In fact, Mototani et al. does not provide any specific kerosene absorption characteristics, and thus does not teach or suggest the importance or desirability of Applicant's claimed kerosene absorption range. By employing an electrically conductive carbon having a kerosene absorption in the range of 2.2 to 3.5 ml/g, Applicant's cell advantageously achieves enhanced performance as is evidenced in FIGS. 4 and 7. As is particularly shown in FIG. 7, the average cell performance is significantly enhanced by employing expanded graphite having a kerosene absorption value within the claimed range of 2.2 to 3.5 ml/g, and provides the most noticeable advancement in performance within the range of 2.7 to 3.1 ml/g. Applicant submits that these performance results are not achieved by a mere obvious optimization, as Mototani et al. does not even suggest the significance or advantage of employing expanded graphite having certain kerosene absorption characteristics.

With respect to claim 11, Applicant's invention provides for an electrochemical cell comprising a positive electrode having an active material and an electroconductive carbon material including expanded graphite particles having a purity level greater than 99.9 percent, as determined by weight loss on ignition. Nowhere does Mototani et al. teach or suggest the

use of expanded graphite in a positive electrode with a purity level greater than 99.9 percent. In fact, Mototani et al. likewise fails to even mention the significance of employing high purity expanded graphite. Accordingly, claim 11 and dependent claims 12-15, likewise are not rendered obvious in view of Mototani et al.

In claim 16, Applicant's invention provides for an electrochemical cell having expanded graphite with an average particle size in the range of 17 to 32 micrometers, a d_{90} value in the range of 40 to 85 micrometers, a d_{10} value in the range of 3 to 9 micrometers, a kerosene absorption value in the range of 2.2 to 3.5 ml/g, a tap density in the range of 0.09 to 0.14 g/cc, and a Scott density or no greater than 0.07 g/ml. The reference to Mototani et al. likewise fails to teach or suggest a cell having a combination of these features and, therefore, claims 16 and 17 should likewise be allowed in view of Mototani et al.

By way of the foregoing, Applicant has demonstrated that claims 1-21 are patentable in view of the Mototani et al. reference and the claims should therefore be allowed, which allowance is respectfully requested.

The remaining references made of record were not applied to the claims, and thus are not discussed herein. Applicant has reviewed these references and agrees with the Examiner that such references do not teach or suggest the claimed invention.

In view of the above remarks, it is submitted that claims 1-21 define patentable subject matter and are in condition for allowance, with action is respectfully solicited. If the

Examiner has any questions regarding patentability of any of these claims, the Examiner is encouraged to contact Applicant's undersigned attorney to discus the same.

Respectfully submitted,

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By: Price, Heneveld, Cooper,
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Date

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